

What is claimed is:

1. A field effect transistor, comprising:
a semi-insulating semiconductor substrate;
a semiconductor layer structure provided on the
semiconductor substrate, said semiconductor layer structure
including a non-doped first compound semiconductor layer, an n-
type second compound semiconductor layer having an impurity
doping density ranging from $1 \times 10^{17} \text{ cm}^{-3}$ to $1 \times 10^{18} \text{ cm}^{-3}$ and a layer
thickness ranging from 1nm to 10nm and having an energy level at
a lower end of a conduction band thereof, which is less than or
equal to an energy level at a lower end of a conduction band of
the first compound semiconductor layer, and an n-type third
compound semiconductor layer having an energy level at a lower
end of a conduction band thereof, which is less than the energy
level at the lower end of the conduction band of the second
compound semiconductor layer, said non-doped first compound
semiconductor layer, said n-type second compound semiconductor
layer and said n-type third compound semiconductor layer being
sequentially disposed on the semiconductor substrate from the
semiconductor substrate side; and

a gate electrode disposed on the semiconductor layer
structure, and a source electrode and a drain electrode, said
source electrode and said drain electrode being opposite to each
other with the gate electrode interposed therebetween and being
disposed over the semiconductor layer structure.

2. The field effect transistor according to claim 1,
wherein the first compound semiconductor layer is formed of
AlGaAs, the second compound semiconductor layer is formed of
AlGaAs, and the third compound semiconductor layer is formed of
GaAs.

3. The field effect transistor according to claim 1,

wherein said semiconductor layer structure further comprises a fourth compound semiconductor layer having an energy level at a lower end of a conduction band thereof, which exceeds the energy level at the lower end of the conduction band of the third compound semiconductor layer, on the third compound semiconductor layer.

4. The field effect transistor according to claim 3, wherein the fourth compound semiconductor layer is formed of AlGaAs.